Report No. CDH-DTP-R-85-12

USE OF ROAD OIL BY MAINTENANCE

Herbert N. Swanson
Colorado Department of Highways
4201 East Arkansas Avenue
Denver, Colorado 80222

Interim Report
October 1985

Prepared in cooperation with the
U.S. Department of Transportation
Federal Highway Administration

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views of the Colorado Department of Highways or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
CDOH-DTP-R-85-12		

4. Title and Subtitle	5. Report Date
USE OF ROAD OIL BY MAINTENANCE	October 1985
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Herb Swanson	CDOH-DTP-R-85-12
9. Performing Organization Name and Address Colorado Department of Highways Division of Transportation Planning 4201 E. Arkansas Avenue Denver, Colorado 80222	10. Work Unit No. (TRAIS) 11. Contract or Grant No.
12. Sponsoring Agency Name and Address U. S. Department of Transportation FHWA Demonstration Projects Programs 400 Seventh St. S.W. Washington, D.C. 20590	13. Type of Report and Period Covered Interim 14. Sponsoring Agency Code

15. Supplementary Notes

Prepared in Cooperation with the U. S. Department of Transportation
Federal Highway Administration

16. Abstract

The objective of this study was to determine which materials are most effective for each maintenance activity and thereby, reduce the total number of raod oils purchased and handled. This report covers the first two tasks of the study, a survey of the materials used and a series of interviews with maintenance sections. It is anticipated that emulsions will be more widely used and that the older asphalt cements and cutbacks will be used less. The total number of oils purchased and used has been and will be reduced as a result of the initial activity in this study. The final report will document field tests and evaluations. Final conclusions and recommendations will be based largly on the results from these field test sections.

Implementation Consideration should be given to obtaining proper storage facilities in rural areas.

17. Key Words	18. Distribution Statement
Road Oils, Asphalt Products, High Float Emulsion, Chip Fog Prime, Squeegee, Crack Filler	No restriction. This report is available to the public through the National Information Service, Springfield, VA 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	13	

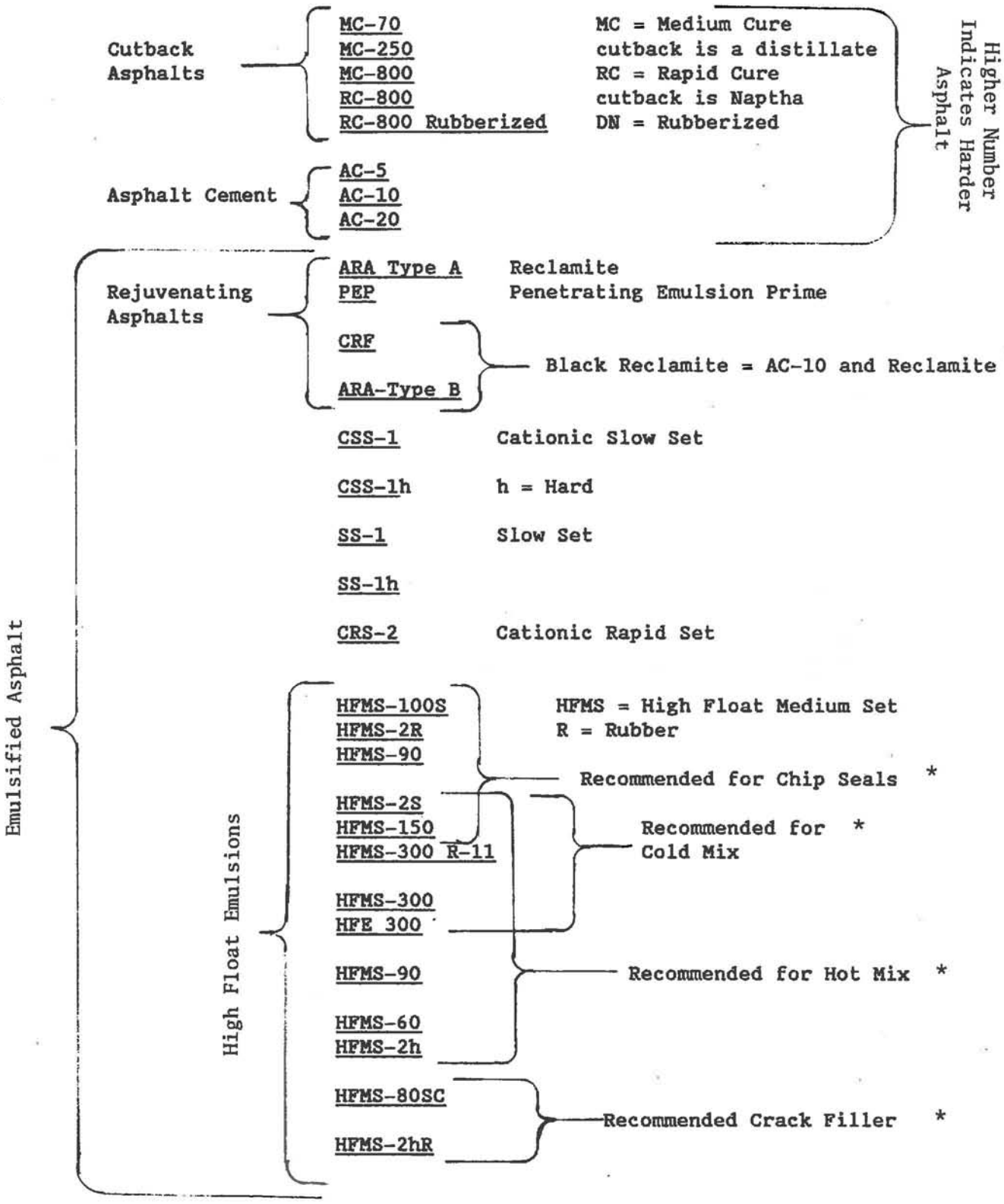
Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

TABLE OF CONTENTS

INTRODUCTION

Eight maintenance sections in Colorado are using twenty to thirty different asphalts or oils in various functions such as tack coat, seal coat, fog coat, crack filling and hot and cold mix production. As many as seven different materials are being used for crack filling. Each section and each foreman has their own ideas of what is the best material for a specific task with little opportunity for comparisons to determine the relative success of their work. There is a need to determine and refine the state of-the-art of the use of asphaltic materials in the maintenance sections of the Colorado Department of Highways. The objective of this study was to determine which materials are most effective for each application, and therefore reduce the total number of road oils purchased and handled. This study has already initiated some additional exchanges of technical information among maintenance supervisors and is expected to provide more exchanges.

Figure 1 is a list of the commonly used oils over the last year and general explanation of some of the acronyms used for these products.



* Manufacturers recommendations

General Explanation of Road Oil Acronyms

Figure 1

INVENTORY OF MATERIALS USED

Early in 1985 a questionnaire was sent to each maintenance superintendent to determine the number of oils and the use of each. All of the superintendents responded by submitting a list of the oils used for nine functions in their respective sections. A composite of this data is summarized in Table A. A map showing the maintenance sections and the areas that each covers is included in the appendix. The oils listed in the top half of Table A (down through SS-1h) represent the older materials which have been available and used for years. The newer high float emulsions at the bottom of Table A have only been in use in Colorado for the last two years but are increasing in popularity. There has been and will continue to be a natural shift or transition from the top half to the newer materials in the bottom half of the table. This shift will continue as maintenance forces become more familiar with and see the advantages of the newer products.

TABLE A

USE OF ROAD OILS BY COLORADO HIGHWAY MAINTENANCE SECTIONS

(Each Number in the Table Represents the Maintenance Section Number Where the Product has been used)

ROAD OIL	Tack Coat	Prime Coat	Chip Seal	Fog Coat	Squeegee Seal	Cold Mix	Hot Mix	Crack Filler	Rejunenating Agent
MC-70	6 8	1 6		1 2 6	1 3 5				6
MC-250	4			5		1			
MC-800	4					3 6	7		
RC-800	2 3 5 6		2	5					
RC-800-DN								* 2 6 7 8	
AC-5	2						*2 3 7		
AC-10							* 1 2 3 4 5 6 7 8		
AC-20							* 5		
Reclamite									1 2 4 5 6 8
PEP		*		4					4
CRF					2 3			* 5	2 3 4 5
CRF-2					1 5			* 1 6	1
CSS-1	1 4 8			8					
CSS-1h	1								
CRS-2			1 3		1			1	
SS-1	* 1 4								
SS-1h	* 4 5			5					
HFMS-100S			*					* 2 4	
HFMS-2R			* 2 4 5 7			4			
HFMS-2S			* 7			*	*	5	
HFMS-150			*			* 1 5	* 2		
HFMS-300					1	* 2 5 6	*	3	
HFE-300						* 2 3 5	*		
HFMS-90	2		*		1 4	3	2 3 4	4	
FMS-60	* 2						* 2 4		
HFMS-2h	*						* 7		
HFMS-300 R-11						*3	*		
HFMS-80SC							4	*	
HFMS-2hR								* 7 8	

* Indicates a use Recommended by the Manufacturers

_ A Number Underlined Indicates the Superintendents Preference for that activity

FIELD INTERVIEWS

A series of meetings with each maintenance superintendent was held during the spring and again in the late summer of 1985 to review the preliminary study findings and to gain additional input. Each asphaltic material for each activity was discussed. In most cases a preference for one or two oils was identified for each function. The superintendent's preferences are underlined in Table A and manufacturer's recommendations are marked by an asterisk. At first glance, this table appears to be a shot gun pattern of too many materials used for all of the activities. However an analysis of each activity indicates that there is not as much variability as first appears. The act of conducting the first two tasks of this study, inventory of materials and field interviews has already caused most of the maintenance supervisors to consider the problem and take some action to discontinue the use of some materials. Interviews with each superintendent, several manufacturers representatives and staff materials personnel provided considerable insight to the activities and the qualities of each material. A discussion of each related maintenance activity and the oils used follows:

1. Tack Coat

A tack coat is an oil sprayed very lightly (0.1 gallons per square yard or less) to tack a new AC mix to an existing pavement. From Table A it can be seen that RC-800 and any of the SS-1 emulsions are preferred, however, several other oils are also used. Emulsion are generally used in the summer since they may be slow to "break" in cold weather.

The main reason the other oils are used is that they were readily available. The material used for tacking is not critical as long as bonding is assured and small quantities are involved, therefore, the use of material on hand is acceptable for this purpose.

2. Prime Coat

A base course should be primed before placement of an AC mix to provide good contact between the two. MC-70 is generally used in both maintenance and contract work.

3. Chip Seal

Chip seals have traditionally been done with rapid cure cutback oils by both construction and maintenance. Most of the maintenance sections have been very successful with chip seals using emulsions, especially high float emulsions, during the last two years. These are the most "forgiving" oils in that equipment breakdown, other delays, errors and even rain and cool weather have not been detrimental. Jobs completed under these conditions have turned out well.

4. Fog Seal

Fog seals are used on sound pavements to check oxidization, raveling and to decrease surface permeability. Either emulsions or cutback asphalts are used depending on the conditions. Emulsions are favored by most of the maintenance superintendents because of availability, ease of handling and environmental considerations.

5. Squeegee Seal

Squeegee seals were developed in Colorado for the purpose of filling large numbers of cracks in older roadways. Several variations in the procedure have been effective. A light weight oil or emulsion along with fine sand are worked over the pavement surface and into the cracks. The procedure seals the surface and fills the cracks with a batter of fine grained asphalt mix. MC oils have traditionally been used however, emulsions are preferred recently.

Most of the men who have used emulsions recently have found that they flow better, fill cracks better and are much easier to work with. Black reclamite, which is a mix of emulsified AC-10 and reclamite has been used very successfully this year and is recommended by central laboratory and maintenance personnel as well as suppliers for future work in this activity.

6. Cold Mix

Medium cure, cutback oils have traditionally been used for cold mix but high float emulsions were favored more in the last year. The emulsions are easier to work with, place and finish.

7. Hot Mix

AC-5, AC-10 and AC-20 are the standard oils for hot mix. AC-5 is recommended for high altitude and cold climates but it is difficult to avoid flushing or bleeding during the summer. Quality control on the gradation, AC content and placement procedures are critical. AC-10 is used throughout most of the state. AC-20 is recommended for eastern Colorado with it's warmer climates and fine sand aggregates. During the last two years, high float emulsion hot mix has been tried by most of the maintenance sections with good results. These mixes are easier to work with and save money and fuel by running the hot plant at lower temperatures (240°F±). These mixes remain tender for a long time and may have a tendency to ravel early. A fog seal or chip seal may be required to prevent raveling. Another option may be to raise the percent of oil slightly as was done in maintenance section 5. Emulsified hot mixes may outlast asphalt cement hot mixes because the lower operating temperatures have not driven off the more volatile components of the oil. The long term performance of these mixes is still under evaluation.

8. Crack Filler

A committee set up to investigate crack filling in Colorado has recently submitted a Maintenance Policy for Crack Filling in Colorado. The acceptable materials listed in this policy paper are: scrap rubber/asphalt cement mixture, RC-800 ~~DN~~R, CRF and HFMS-rubberized (eg. Styrelf). From Table A, the above materials also are those marked with an asterisk indicating manufacturers recommendations, and are used by most maintenance sections.

Crack filling has been a low priority function in Colorado until recently. Most of the maintenance superintendents have had success with and like the high float emulsions for crack filling. It is therefore believed that emulsions will be strongly favored as more crack filling is done.

9. Rejuvenator

There are two distinct sets of circumstances which call for the use of rejuvenating agents. The first is a new pavement which shows a tendency to ravel. This is especially needed for fall paving projects. Reclamite or PEP is used to seal the surface and remedy this condition. The second case is an old pavement which is very dry and brittle. CRF (Black reclamite) is recommended to revitalize old asphalt. The volatile portions of the reclamite soak in rapidly and the AC-10 portion seals the surface while slowly penetrating the pavement, providing a longer-lived treatment.

The above discussion completes a more detailed review of Table A. The road oils are generally being used as recommended and there is not as much variation or indiscriminate use of oils as may have been originally conceived.

CONCLUSIONS AND RECOMMENDATIONS

For the last couple of years the highway maintenance sections have been going through a transition from the use of standard oils to the use of emulsions and specifically to high float emulsions for many maintenance functions. Maintenance has led the way in trying and experimenting with these new oils. Maintenance Section 4 was first to use high float emulsions for crack filler and chip or sand seals. Since then most of the other sections have tried them with favorable results. Engineering contract work has included some high float chip seals and at least one crack filling job using emulsions, however, maintenance has used emulsions for many other functions such as tack coats, squeegee seals, cold mix and hot mix. Small scale experimentation with new products and procedures is much easier for maintenance than it would be for contract work which is much more tightly controlled; therefore, technology has advanced faster and easier in maintenance.

High-float emulsions have several advantages over the old standard oils including lower working temperatures, high productivity and in many cases, a better and longer lasting job. A major disadvantage is the lack of adequate storage in rural maintenance sections such as Craig (Section 6) and Alamosa (Section 7). These oils must be kept in a sealed tank, above 40°F and must be used within three months. Some consideration should be given to obtaining proper storage facilities in rural areas.

It is anticipated that within the next two years, most sections will be using emulsions for most functions and very few standard asphalts.

The total number of oils purchased and handled has been reduced by 15% as a result of the initial activity of this study.

Several test sections have been set up and materials placed. Many more are currently being installed and several planned. Table B is a listing of the materials, activities and maintenance sections where test sections have been, are being, or will be placed. Each entry in Table B represents at least one test section in that Maintenance Section area. Additional test sections and materials may be added to this list. The final report will document the results of these field tests. Final conclusions and recommendations will be based largely on the field test results.

TABLE B

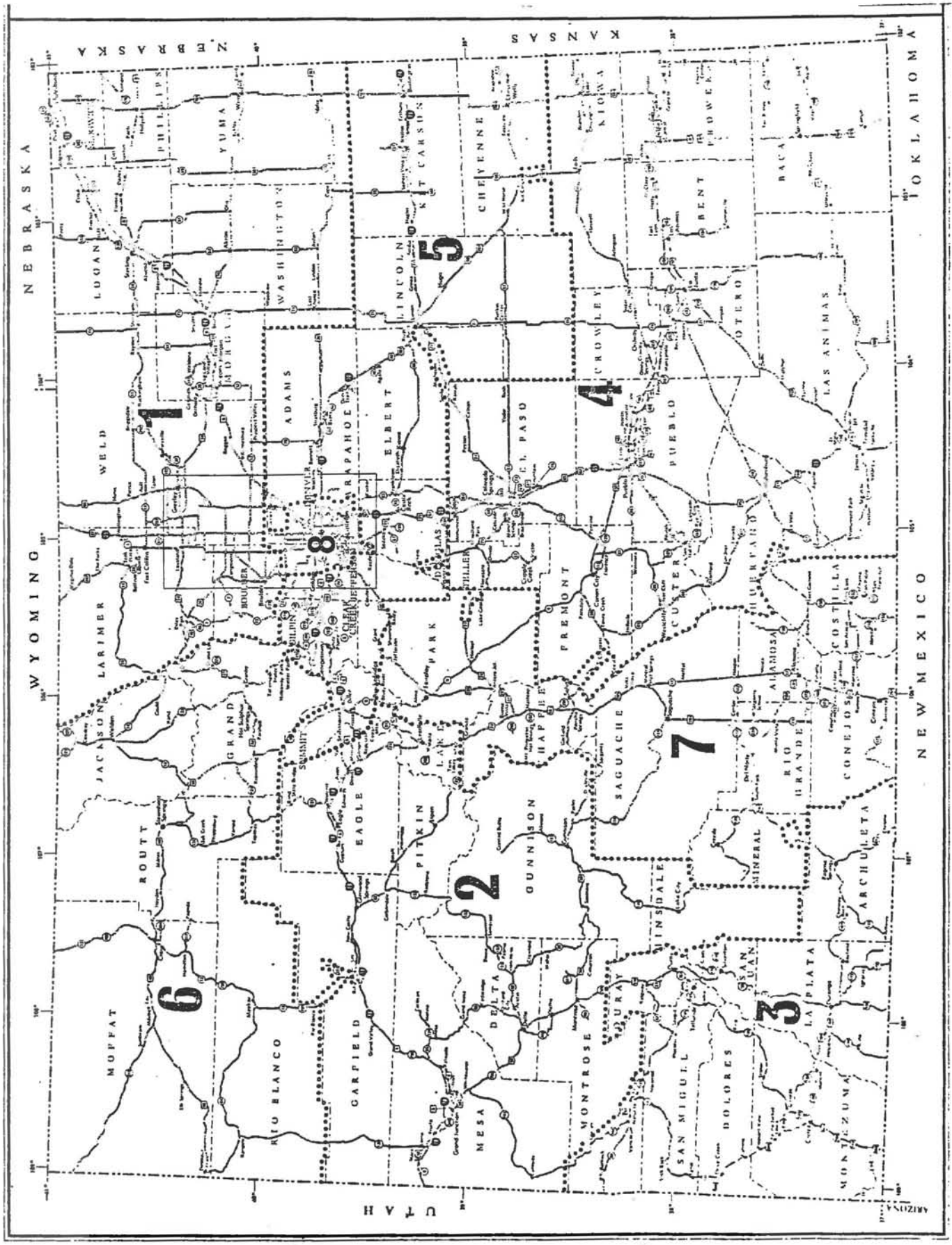
USE OF ROAD OILS TEST SECTIONS

(Each Number in the Table Represents the Maintenance Section Number Where test sections will be evaluated)

ROAD OIL 1985	1986	Chip Seal	Squeegee Seal	Cold Mix	Hot Mix	Crack Filler
MC-250				567&8		1&5
MC-70,250& Fiber Fill				137&8	8	1&7
Sylvex				1		
Flex-A-Fill						123456&7
RC-800		6&7			7	356&7
RC-800-DN						2&6
AC-5					7	
AC-10				6	2357&8	
AC-20R					3&7	
ARA						8
ARB =CRF		3&7	13&5			1357&8
CRS-2R		8	5			6
HFMS-2R	HFMS-2(P)	367&8		7		1234567&8
HFMS-2S	HFMS-2S		1	3&6	35&7	
HFMS-150	HFMS-2S		5	5&3		
HFMS-60	HFMS-2h				235&7	
HFMS-90	HFMS-2				2&3	

APPENDIX A

MAINTENANCE SECTIONS IN COLORADO



MAINTENANCE SECTIONS
Figure 2